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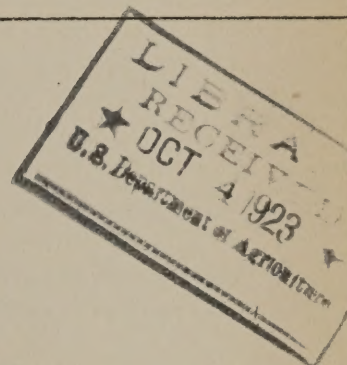
COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS

U. S. Department of Agriculture  
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CROP ROTATION

Excerpts from 1922 Annual Reports  
of State and County  
Extension Agents.



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## Colorado

This project was undertaken as a basic one on which to work for a number of years. Crop rotation is needed in this State, but it is not followed by a sufficient number of farmers. Through this project we hope to correct some of these shortcomings. It has been taken up in crop schools in six counties and at meetings in some of the other counties.

\*No attempt is made to cite all references to crop rotation in this circular. Only selected extracts showing typical methods employed and results secured in a large number of States are included. Owing to differences in terminology used in the various States and to other local conditions, the information contained in this circular should be reviewed by the State subject-matter specialist concerned before incorporating any part of it in the extension plans for that State.



A study of the plant needs and soil requirements was made before the rotation work was studied. Then a rotation skeleton was worked out for the community, leaving the farmer to fit into this skeleton the crops that he wanted to grow. Lincoln and Otero counties are doing the best work along these lines. In Lincoln county, the farming has been a one-crop system, raising wheat on the hard lands in the north end of the county and corn or beans on the sandy lands in the south end. The size and quality of the wheat yields have been decreasing, due to the lack of rotation. The soil in the south end of the county is blowing away, because of the absence of organic matter and the continual stirring of the land in raising corn or beans. As a result, a start at a rotation has been made in the north end of the county on cultivated crops, fallow and legumes, and in the south end by the use of listing corn and the planting of fall grains between the rows early in the fall and then letting the stalk stand. The wheat is cut high and the stubble is left to hold snow the following winter. The stubble ground is then listed and planted to corn. These methods are producing good results and farmers are following the county rotation plan. The farmers in Otero county for years have been raising sugar beets, cantaloupes and vine-crop seeds as their principal projects. These are all garden crops which require the maximum amount of cultivation and irrigation. Such conditions have been conducive to bacterial development in the soil and an accumulation of a large amount of nitrates. This year a crop rotation project has been planned and worked on.- Waldo Kidder, Extension Agronomist, State Agricultural College of Colorado, Fort Collins.

#### Kansas

Not only are most of our soils deficient in plant food elements, but they are of a poor physical nature. The constant cropping system has so lowered their humus content that they lack water-holding properties. Crops, therefore, "burn out" easily. The soils are shallow and poorly drained, and the almost impervious subsoil makes excessive rainfall ruinous. This condition is intensified by the lack of humus. With the advent of the Great War all available land was seeded to wheat and for the past five years the annual wheat acreage has been from 75,000 to 125,000 acres. A large percentage of the farms grow practically no other crop. The establishment of a good crop rotation has been a difficult matter in view of the popular stampede to wheat farming. However, by publicity, by using the influence and testimony of successful farmers who use good rotations, and by personal solicitation, some farmers are being prevailed upon to adopt the plans suggested for rotating their crops. This year approximately 20 per cent of all farmers have modified their farming system insofar as to sow less wheat and more grass or leguminous crops. - Roy E. Gwin, County Agent, Columbus, Cherokee County.

#### Kentucky

Any permanent system of soil improvement must include a definite rotation in which a legume appears at least once. The plan we have used here gives us a legume always growing on two fields of the three, and provides for the winter turning-under of a heavy legume crop every third year.



This system of soil building and rotating of crops has been accepted by the farmers of the county and they are fast putting it into practice. Their increased knowledge of the intelligent use of fertilizers coupled with 100 per cent increase in cover crops and well-established rotations gives some indication of the ultimate value of this campaign in dollars and cents. Closely identified with the improvement of crops and pastures is the live stock industry. I believe the best way to increase interest in live stock is to fill the crib with corn and the loft with provender, with acres of grass waving an invitation to hungry herds. Our rotation anticipates more live stock than we ever have had before. In fact, we must have more live stock to take care of increased crops and pasture. -- W. R. Whitlow, County Agent, Russellville, Logan County.

#### Michigan

Due to high prices paid for hay by lumber camps in the county, many farmers have allowed 80 per cent of their land to grow timothy hay year after year. Through the efforts of the county agent many acres of these old meadows have been plowed up and a diversified system of farming begun. The growing of clover for dairy cattle has been stressed and farmers have been urged to grow winter wheat and winter rye. Sunflowers give promise of being one of the best silage crops. -- W. N. Clark, County Agent, Ewen, Ontonagon County.

#### Minnesota

County extension work has been carried on with a view to establishing a permanent and profitable agriculture. To this end all farmers have been assisted and advised in preserving the fertility of their soils, practicing crop rotation, the growing of legumes and the keeping of live stock. With a view to standardizing the crops grown to those best adapted, the following varieties were recommended:

- |            |   |
|------------|---|
| Corn       | - Minnesota 13 and Northwestern Dent for ensilage           |
|            | Minnesota 23 and Northwestern Dent (yield of mature grain). |
| Sunflowers | - Mammoth Russian   |
| Soy beans  | - Wisconsin Black   |
| Oats       | - Victory (medium late); Kherson (early, for peat)          |
| Barley     | - Manchuria.  |
| Potatoes   | - Green Mountain, Cobbler, Russet.                          |
| Rye        | - Minnesota No 2 and Rosen.                                 |
| Wheat      | - spring, Marquis; winter, Minturki.                        |
| Buckwheat  | - Silverhull.   |
| Flax       | - Primost.  |



The following rotation was recommended as one which would keep the hay up to standard:

- 1st year - Cultivated crop - corn, potatoes, sunflowers.
- 2d year - Small grain; seeded to timothy and clover.
- 3d year - Timothy and clover hay.
- 4th year - Timothy and clover hay.

The advantages of this rotation are:

- 1. Provides grain, hay, succulent feed and a cash crop.
- 2. Distributes labor throughout the growing season.
- 3. Provides for keeping of live stock, thus keeping the soil fertility up to normal. - A. W. Jacob,

County Agent, Aitken, Aitken County.

Our big work has been in the promotion of a changed system of farming leaving behind the old one-crop grain system and replacing it with live stock, dairy cattle, hogs and poultry, as well as good beef cattle. The large increase in the number of dairy cows has resulted in the creameries increasing their output 25 to 40 per cent during the year. In order to promote better feeding a crop-improvement program has of necessity developed, whereby the growing of leguminous crops, alfalfa and clover, particularly, has been given a permanent place in our program. A large acreage of these two has been planted, in part at our suggestion, resulting in better feed and in improvement of soil. Soy beans are also proving to be a very satisfactory supplement for silage. The campaign to grow more legumes has been linked very carefully with the program of "making" the farm feed the cow." - T. G. Stitts, County Agent, Litchfield, Meeker County.

### Missouri

An increase of the yield of potatoes by one-third and the production of superior quality resulted from turning under a crop of cowpeas for green manure on land which had been cropped continuously for 12 years to potatoes. No organic matter had been added in the form of manure or other vegetation except weeds or potato stems. That farmers might recognize the merit of approved cropping systems which will retain soil fertility and build up the humus content of the soil, demonstrations are being established as fast as cooperators are found, and many farmers are being assisted in determining some phase of crop rotation. - J. A. Krall, County Agent, Liberty, Clay County.

### North Carolina

The main problem being attacked in this work is the improvement of the soils of North Carolina. Nine-tenths of the farm revenue of this State is derived from crops. Crops, live stock, and the farmers' prosperity in general are dependent more upon the soil than on any other one thing. We are recommending organic matter as the one greatest need of our soils. A sufficient quantity of this material can be secured only through suitable crops and crop residues, for the State produces a relatively small amount of live stock in



proportion to the land in cultivation. Legumes are considered the best crops for the purpose because they can utilize nitrogen from the air. The taking off of any crop, even a legume crop, does not improve the soil but injures it to some extent. Therefore, we recommend that some suitable crop be turned under to supply organic matter and plant food to the soil. Systematic rotation will facilitate soil improvement in this manner, and diversification of crops goes hand in hand with soil improvement and the practice of rotations. This fact has been established. With some soils lime is of direct benefit to all crops; on many more soils it directly benefits legumes and when the legumes are plowed in, enriches the soil for succeeding crops. Fertilizers should be used to increase crop yields in a soil-building rotation, and we have considerable information on the proper use of fertilizers in all parts of North Carolina. Our work has been done almost entirely in cooperation with county agents, agricultural high schools and fairs. Thirty counties were visited during the year and advice given to about 300 farmers. - C. B. Williams, Agronomy Specialist, North Carolina State College of Agriculture and Engineering, Raleigh.

#### North Dakota

The raising of more feed crops was urged not only at the feed schools listed, but at the diversified-farming meetings held at seven different places with 109 farmers present. Practically all present at these meetings agreed to raise more feed crops such as oats, barley and corn, cutting down their acreage of wheat. Many signified their intention of putting in a considerable acreage of sweet clover and alfalfa. Several cropping systems are being tried out in the county. The Northern Real Property Co. has been using the following system for the past three years: 1st year, corn; 2d year, wheat seed and sweet clover; 3d year, sweet clover; 4th year, flax; 5th year, barley. This system has not been in operation long enough to show increased yields, although this year an excellent crop of flax was secured on sweet clover ground. Next year the company will put a systematic cropping system on all of their farms. M. H. Fallis of Jamestown, Frank Zimmerman of Cleveland, and Ben Orlady of Jamestown have cropping systems in operation. They are also making use of sweet clover as a soil builder and a cultivated crop to remove the weeds. - R. S. Goodhue, County Agent, Jamestown, Stutsman County.

#### Oklahoma

The improvement of the soil is being given more attention each year. The farmer is beginning to realize the necessity of maintaining the fertility of the soil and that the one-crop system is rapidly depleting the soil. The principal methods used in soil improvement are crop rotation, legume growing, and the use of manure, although terracing is being practiced quite extensively on the east side of the district. All county projects include soil-improvement work. - B. F. Markland, District Agent, Oklahoma Agricultural and Mechanical College, Stillwater.

When farmers working on the fertile farms along the Washita and Blue river bottoms fail year after year to make a living from cotton and corn, it



becomes apparent that there is something materially wrong with their system of farming, since other farmers on the uplands are staying on the job and making a good living. The former complains that he does not have time to milk cows, and that the chickens eat up the horses' feed and the old sow eats the chickens. The latter farmer finds that it pays him to keep some cows, a few brood sows and many chickens, - and you might observe that he is in the field each day about as long as the one-crop farmer. With repeated cotton failures and low prices for feed crops, it is becoming easier to interest farmers in diversification and the fact that the dairy cow, the hen and the sow form necessary parts of their farming activities. Some day this county will be a real dairy county, for we can produce feed of all kinds, alfalfa, cowpeas, other legumes, sorghum and of course, corn and cotton seed. Some 500 pure-bred registered Poland China gilts were in the county at the beginning of this past year as a result of our pig-club work begun in 1920, and in a few years there should be a sow for every farm in the county. Day-old chicks from reliable poultrymen have given us quite a start in pure-bred poultry, and turkey raising is quite profitable. - John P. Gray, County Agent, Tishomingo, Johnson County.

### Oregon

Having determined what crops and varieties of crops are best adapted to the soil of any particular farm, the question of next and immediate importance is a proper combination and sequence of crops in order that (1) the immediate profits may be as large as possible, (2) that the farm business be insured against widely fluctuating income by a proper diversification, (3) that profits be progressively increased through building up soil fertility, with consequent increase of yields. In proceeding to adopt a systematic and definite crop rotation to any particular farm such factors as (1) soil type, (2) size of farm, (3) transportation facilities, (4) individuality of the operator, must necessarily be considered. At best it is a difficult and perplexing problem to attempt to outline crop rotations which would be workable for all conditions. It can be approached only with the idea of establishing a standard, with suggestive alternatives for variable conditions; the whole to serve as a guide to the individual farmer, that he may have a well considered starting point from which to plan his own cropping system.

That there is need for work in this direction cannot well be disputed. Except for a certain number of specialized farms, such as orchards, dairies, cattle ranches, and so forth, scarcely 1 per cent of the farms is now being operated on a systematic basis. Of the factors enumerated above, immediate income is the motive of most of the cropping, and decisions are reached from year to year largely according to the operator's guess and prospective markets. The other two requisites, insurance and increased productivity, are subordinated or forgotten. This condition cannot be changed rapidly, nor can it ever be changed completely. There are, however, a large number of farmers who are anxious to change not only their cropping systems, but their entire farm-management plan, if a workable, practical plan could be suggested to them. The greatest need for this kind of demonstration work is upon the better-irrigated lands of the Snake River and Malheur River valleys. Here the average farms are smaller than in other parts of the county and they are naturally given to diversified farming. Farm-management surveys taken by the



United States Department of Agriculture have shown that the most profitable farms are usually the two-man units. For general purposes this would require about 80 acres of average land in the section referred to above, as this is the average-sized farm. Therefore it will be used as a basis from which to formulate suggestive crop-rotation plans.

To lay the foundation for crop-rotation demonstration work the agent has conducted crop and farm business surveys during the past three years. He also has made a study of yield, farm price and cost of production data available from farm-management surveys by the United States Department of Agriculture, figures compiled by the University of Idaho on farm costs and relative profitableness of farm crops in Twin Falls County, Idaho, statistics compiled by the United States Department of Agriculture and the Idaho Department of Agriculture on average farm prices, and individual statements on cost production secured from farmers. From this study it appears that the most dependable rotation for an 80 acre farm of the better-irrigated lands from the standpoint of sale of cash crops is, Wheat, Clover 1, Clover 2, Cultivated Crops. A definite project, has been prepared, setting forth in some detail the reasons for the adoption of this rotation and outlining procedure for the establishment of demonstration farms. Plans have been made to put it into effect by holding crop-rotation and farm-management meetings and selecting demonstrators. Dairying, poultry husbandry and hog raising should be encouraged along conservative lines and work undertaken to improve the average yield and quality of both the range-and farm-flock fleeces. - L. R. Breithaupt, County Agent, Ontario, Malheur County.

### South Dakota

The value of legumes in a rotation is one of the oldest subprojects, the work has been carried on in 30 counties of the State. Alfalfa, sweet clover, and soy beans have been the principal legume crops planted. The average number of acres per demonstration was 15, which for the 105 demonstrations made 1,575 acres. This is only a part of the total number of acres planted due to the influence of this subproject.

Soy beans are now being grown in many parts of the State and it has been found necessary to conduct some variety demonstrations. During the past year 32 counties had these demonstrations making a total of 192 for the State. The principal varieties demonstrated were Mandarin, Manchu, Manchuria, Wisconsin Early Black, and Black Eyebrow.

Demonstrations in improved field-crop seeds received more attention than all others. These numbered 362 and were conducted in 54 counties, covering 13,530 acres. The following is a brief summary of the demonstrations as they are divided into different crops:

All small-grain crops -	numbering 188 with 5,829 acres.
Corn	numbering 14 with 280 acres.
Clovers	numbering 13 with 130 acres.
Soy beans	numbering 15 with 75 acres.
Flax	numbering 7 with 105 acres.
Alfalfa	numbering 126 with 7,120 acres.

These are all definite demonstrations in the planting of pure seed of the best varieties for the production and increase of such seed.



A question of vital importance to the majority of South Dakota farmers is, "What crops shall I plant?" Farmers everywhere in the State are asking this question. A wide-awake Lincoln County farmer put this question up to his county agent and the discussion led to soy beans and winter grains. This was a new departure in cropping systems and the question of methods, varieties, and sources of seed was somewhat puzzling. In giving assistance the agronomy specialist recommended Manchou soy beans and Rosen winter rye and was able to give definite sources of good seed near at hand. This progressive farmer has already harvested a crop of soy bean seed and planted the winter rye in the soy bean stubble. Sweet clover will be planted in the spring on the rye field and then plowed under the following spring for corn. This is an entirely new crop-rotation system for South Dakota. It is sound and will no doubt be the means of modifying the cropping systems on many southeastern South Dakota farms.

Corn has been for years an important crop in all of southeastern South Dakota and in recent years has increased in importance in all other parts of the State. - Ralph E. Johnston, Agronomist, South Dakota State College of Agriculture and Mechanic Arts, Brookings.

### Tennessee

Humphreys County produces a heavy corn crop, due to its creeks and rivers, but it is not equally productive of hogs. We realized the need of more hogs and with the assistance of the live stock specialist and the farm bureau live stock committee we worked out a plan to bring pure bred gilts into the county and sell them to the farmers at cost, plus expenses. In December, 1921, 25 Poland China gilts were purchased by the farm bureau and sold to 15 farmers. The county now has 85 pure bred Poland Chinas and over 100 Durocs. There has been an increase of 30 per cent in the number of brood sows during this year. Grade rams gradually are being displaced and there are now 44 pure bred rams in the county.

With only five inmates, the county farm of 320 acres with 80 in cultivation, has been costing the county over \$800 a year in excess of its proceeds. New commissioners were elected and in the spring of 1921 they asked me to meet with them to work out a rotation for the farm. We started it that spring, dividing the acreage for the principal crops into four fields of 15 acres each, leaving the rest for truck crops and pasturage.

Corn	1921	:	Soy beans	1921
Soy beans	1922	:	Wheat	1922
Wheat	1923	:	Red clover	1923
Red clover	1924	:	Corn	1924
Corn	1925	:	Soy beans	1925
<hr/>				
Oats	1921	:	Wheat	1921
Corn	1922	:	Red clover	1922
Soy beans	1923	:	Corn	1923
Wheat	1924	:	Soy beans	1924
Red clover	1925	:	Wheat	1925

We limed the soy bean and oat fields in the fall of 1921, seeding the oat field to crimson clover for corn this year, and the other to wheat. The rotation is to lime the soy bean field, plant to wheat and sow red clover on



wheat in the spring. Rye is seeded in the corn. The first crop of red clover is cut for hay, and the second crop turned under and seeded to crimson clover. The rotation is successful and is causing favorable comment. - T. H. Richardson, County Agent, Waverly, Humphreys County.

### Utah

Crop rotation is essential to the maintenance of a fertile soil and good clean crops. One hundred and ninety-nine farms containing 6,693 acres are now platted, and being worked on definite systems of rotation. These rotations are based on the principle of having a manurial crop, a money crop, and a cleansing crop in each rotation system. They differ in various parts of the State both as to length of rotation and as to crops, according to the needs of the soil and of the farmer. - J. C. Hogenson, Agronomist, Agricultural College, Logan.

### Virginia

I have encouraged farmers to raise more hogs and poultry as a paying side line, and have recommended a rotation for their hogs which would graze them the year round. This consisted of old-fashioned clover and wheat, corn and soy beans, planting three varieties so as to have them maturing from July 1st until fall. At present there are 40 farmers who are practicing all or part of this rotation. Four of these have reported that the acres thus used have netted them \$20, \$34, \$40, and \$50, respectively. Several carloads of hogs have been shipped this year. In several communities trucks have been put on to move surplus hogs, cattle, sheep, poultry, etc., to market. - Joe Bellinger, jr., County Agent, Petersburg, Dinwiddie County.

Systematic crop rotations have been worked out for seven demonstrators. Five of the rotations were carried out with good results. The chief crops planted were corn, wheat, clover and pasture. A rotation for small farmers consisted of corn, rye, peas and grass mixture. Pure-bred hogs and grazing rotations have been the major lines of live-stock work. I believe that hog raising for market is the coming live stock industry in this county, climate, soil, good grazing crops and nearby markets being favorable factors. - L. M. Walker, jr., County Agent, King George County.

### Washington

Too many farmers have been following a specialized-farming practice instead of a diversified system. The specialized farms in most cases have not been as successful as diversified farms. No one rotation will fit all farms or all conditions, but a few suggestive rotations are outlined as a basis from which to work:

Eight year rotation: Alfalfa 4, potatoes 1, beets 1, corn 1, wheat 1; or  
Alfalfa 4, potatoes 2, corn 1, wheat 1; or  
Alfalfa 4, potatoes 2, wheat 2.

Seven year rotation: Alfalfa 3, potatoes 1, beets 1, corn 1, wheat 1.  
At least three crops should be grown and preferably four or five.



In Yakima County the necessity for soil fertility can not be too strongly emphasized. In the past most of the crops in the valley have been shipped out, which means that there is a continual drain on the soil with little effort being made to return to it any plant food. In order to correct this undesirable condition it will be necessary to follow a more diversified farming and crop-rotation system, and to feed a certain portion of the bulky crops to live stock. This will produce manure to increase or to maintain soil fertility. In addition to barnyard manure, green manure is productive of soil fertility. Soils in Yakima County generally are lacking in humus or organic matter. By plowing under green manure such as alfalfa or other legumes, rye or such crops, the humus may be increased.

The growing of alfalfa is on too large a scale to be profitable, many farmers growing no other crop. When there is a slump in the price, as is often the case, the single crop fails to make a profit. If other crops were introduced into the rotation the chance of loss would be lessened. Where alfalfa is grown continuously it becomes badly infested with "cheat" and other noxious weeds. This lowers the grade which in turn lowers the price per ton. To avoid "cheat", alfalfa should not be left in longer than four years. Much of this bulky feed should be consumed in the valley by dairy cattle, beef and sheep.

Corn Many farmers think that corn is an unprofitable crop in the valley. This may be true under the present system of farming. It could, however, be made a very profitable crop if the farmers had more hogs or if more corn were put into silos for dairy cows or other stock feeding.

Sugar beets Sugar beet growing is not as yet satisfactory. Not enough attention has been given to the selection of the land and the handling of the crop, which requires too much expense to be grown on poor land. Beets should be grown on the best soil where the fertility is properly maintained by crop-rotation methods and the application of barnyard manure or other sources of fertilizer, such as green manure and the growing of legumes. Soil that will not produce good potatoes or other crops should not be planted to beets.

Potatoes Potatoes are considered as one of the best-paying crops in the Yakima valley, but the uncertainty of an over supply often means a financial loss to many farmers. At the present time the acreage is out of proportion to other crops and with an over supply many farmers will lose heavily.

Wheat While wheat is planted over considerable acreage in Yakima County, it is not a crop that gives large financial returns. Wheat is used primarily as a nurse crop when seeding back to alfalfa, but there are many "one-crop farmers" who grow it quite extensively. In fact a number of farms have been noted where this crop has been grown from five to seven years on the same piece of land without changing to other crops. As a result it is difficult to get 30 bushels of wheat where the yield ought to be 60 bushels. - Grover Burnett, Assistant Extension Specialist, Yakima.